ZDOL Hard Coat Surface Chemistry Measured by Soft X-ray Absorption: Initial Results	U7A

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Preservation of the integrity of the ZDOL lubricant is important for the long term reliability of the magnetic hard disk media. The industry standard is to apply ZDOL in a dip coating process (in air) after the vacuum sputtering of the carbon hard coat to the media is complete. Recently Intevac is developing an alternative lubricant coating technique utilizing vapor deposition in vacuum through the support of the Advanced Technology Program. From this initial set of results described below, it appears that the in situ vapor deposition produces a chemical interaction between the lube and the hardcoat. This chemical interaction promotes the bonding and the retention of ZDOL to the hardcoat at a significantly higher level then the standard dip coating process.

We have utilized the chemical and surface (10 nm) sensitive of soft x-ray absorption spectroscopy to probe the ZDOL carbon hardcoat interface above the surface of magnetic media hard disks. The chemical bond specificity of the soft x-ray absorption technique enables the differentiation of the carbon in ZDOL from the hardcoat. Hard disk samples were prepared by standard dipping of ZDOL and the vapor process as described above. Coating thicknesses were determined by FTIR spectroscopy at Intevac. The x-ray absorption spectra were measured at the Dow/NIST soft x-ray materials characterization facility located at the National Synchrotron Light Source.

Carbon K edge x-ray absorption spectra of dip (1.04 nm) and vapor ZDOL coatings (1.42 nm and 15 nm). The thick ZDOL spectra show two dominate peaks, C-C and C-F. The dip and vapor spectra show the characteristic ZDOL peaks as well as the C=C peak from the hard coat substrate. The hard coat C=C peak is less attenuated and thus appears larger for the thinner dip coated sample. Another peak is clearly visible for the vapor lube sample at about 286 eV just above the C=C substrate peak. This feature also appears as a very weak shoulder on the dip lube sample. We believe that this new peak could be indicative of a chemical interaction between ZDOL and the carbon hard coat, perhaps complexing producing unsaturated carbon at the interface. It is significant to note that the observed new interface peak is not present in the ZDOL or the hardcoat spectra.

As a further test the ZDOL coated samples were solvent washed to remove the "mobile" or "unbonded" lubricant. Carbon K edge x-ray absorption spectra of the washed dip (0.15 nm), washed vapor (1.1 nm) coated samples and the thick (15 nm) unwashed vapor coated spectra for reference. The washed vapor lube sample retained about 60% of the ZDOL lubricant and retains the interface peak. In contrast, the washed dip coated sample retained only 10% of its lubricant and has the spectroscopic appearance of a nearly blank hardcoat substrate.